Department of Energy
Washington, DC 20585

QA: N/A
DOCKET NUMBER 63-001

June 25, 2009

ATTN: Document Control Desk
Christian Jacobs, Senior Project Manager
Project Management Branch Section B
Division of High-Level Waste Repository Safety
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
EBB-2B2
11545 Rockville Pike
Rockville, MD 20852-2738

YUCCA MOUNTAIN - REQUEST FOR ADDITIONAL INFORMATION - VOLUME 2, CHAPTER 2.1.1.3, SET 3 (U.S. DEPARTMENT OF ENERGY'S SAFETY ANALYSIS REPORT SECTIONS 1.6 AND 1.7) - Identification of Hazards & Initiating Events

Reference: Ltr, Jacobs to Williams, dtd 04/09/09, "Yucca Mountain -Request for Additional Information -Volume 2, Chapter 2.1.1.3, Set 3 (U.S. Department of Energy's Safety Analysis Report Sections 1.6 and 1.7)"

The purpose of this letter is to transmit three (3) U.S. Department of Energy (DOE) responses to Request for Additional Information (RAI) Numbers 6, 8, and 15, identified in the above-referenced letter. DOE is also submitting one reference that is cited in one of the RAI, but which has not been previously provided to NRC.

DOE previously submitted its response to RAI Number 1 of this set on April 17, 2009. DOE's provided the responses to RAI Numbers 3, 4, 5, 7, 13, 14, 18, 19, and 21 on May 11, 2009. Electronic attachments associated with RAI Numbers 5 and 21 were submitted on May 13, 2009. DOE submitted the response to RAI Number 2 on May 27, and its response to RAI Number 17 on June 10, 2009. DOE expects to submit its responses to the remaining RAIs in this set on or before July 31, 2009.

There are no commitments in the enclosed RAI response. If you have any questions regarding this letter, please contact me at (202) 586-9620, or by email to jeff.williams@rw.doe.gov.

Jeffrey R. Williams, Supervisor
Licensing Interactions Branch
Regulatory Affairs Division
Office of Technical Management

OTM: SEG-0846

Enclosures (4):

1. Response to Request for Additional Information, Volume 2, Chapter 2.1.1.3, Third Set, Number 6
2. Response to Request for Additional Information, Volume 2, Chapter 2.1.1.3, Third Set, Number 8
3. Response to Request for Additional Information, Volume 2, Chapter 2.1.1.3, Third Set, Number 15
4. BSC (Bechtel SAIC Company) 2008. *Geologic Repository Operations Area North Portal Site Plan.* 100-C00-MGR0-00501-000 REV 00F. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080125.0007.

cc w/encls:
J. C. Chen, NRC, Rockville, MD
J. R. Davis, NRC, Rockville, MD
R. K. Johnson, NRC, Rockville, MD
A. S. Mohseni, NRC, Rockville, MD
N. K. Stablein, NRC, Rockville, MD
D. B. Spitzberg, NRC, Arlington, TX
J. D. Parrott, NRC, Las Vegas, NV
L. M. Willoughby, NRC, Las Vegas, NV
Jack Sulima, NRC, Rockville, MD
Christian Jacobs, NRC, Rockville, MD
Lola Gomez, NRC, Rockville, MD
W. C. Patrick, CNWRA, San Antonio, TX
Budhi Sagar, CNWRA, San Antonio, TX
Bob Brient, CNWRA, San Antonio, TX
Rod McCullum, NEI, Washington, DC
B. J. Garrick, NWTRB, Arlington, VA
Bruce Breslow, State of Nevada, Carson City, NV
Alan Kalt, Churchill County, Fallon, NV
Irene Navis, Clark County, Las Vegas, NV
Ed Mueller, Esmeralda County, Goldfield, NV
Ron Damele, Eureka County, Eureka, NV
Richard Cervantes, Inyo County, Independence, CA
Chuck Chapin, Lander County, Battle Mountain, NV
Connie Simkins, Lincoln County, Pioche, NV
Linda Mathias, Mineral County, Hawthorne, NV
Darrell Lacy, Nye County, Pahrump, NV
Jeff VanNeil, Nye County, Pahrump, NV
Joe Kennedy, Timbisha Shoshone Tribe, Death Valley, CA
Mike Simon, White Pine County, Ely, NV
K. W. Bell, California Energy Commission, Sacramento, CA
Barbara Byron, California Energy Commission, Sacramento, CA
Susan Durbin, California Attorney General’s Office, Sacramento, CA
Charles Fitzpatrick, Egan, Fitzpatrick, Malsch, PLLC

EIE Document Components:

001_NRC_Ltr_2.2.1.1.3_Set_3_RAI_6_8_15.pdf	
002_Encl_6_8_15_2.2.1.1.3_Set_3.pdf	2,634 kB
003_100_C00_MGR0_00501_000_00F.pdf	5,034 kB

RAI Volume 2, Chapter 2.1.1.3, Third Set, Number 6:

> Provide the technical basis for screening out mass wasting and landslide, identified in SAR Table 1.6–8 External Event Identification and Crosswalk to Assigned Categories, as potential initiators of event sequence in the repository facilities. DOE excluded these events in SAR Section 1.6.3.4.2 Nonseismic Geologic Activity by stating that necessary topographic and geologic conditions do not exist. However, geologic records and recent observations show mass wasting events continue to occur at the repository site area. SAR Sections 1.1.7.2.1 and 1.1.7.2.2 describe storm-triggered debris flow on the South hill slope of Jake Ridge and storm-triggered mass wasting events around Midway Valley. SAR Section 1.1.4.1.2.2 describes a plan to construct two diversion channels to protect the GROA from floodwater and debris flow originated from Exile Hill; however, design details and adequacy of the design were not provided.

1. RESPONSE

The technical basis for screening out mass wasting and landslide is that the topography at the surface geologic repository operations area (GROA) is relatively flat and is not conducive to the generation of debris flows or mass wasting. Further, such events are bounded by the probable maximum flood which is mitigated by design features. Slope stability of Exile Hill is not a concern for the surface GROA due to the presence of bedrock in the upper portions and the flatness of the adjacent alluvial and colluvial portions.

Modern debris flows are rare events, as is evidenced by the preservation of middle Pleistocene colluvium in the Yucca Mountain area and the lack of erosional scars on hillslopes (Coe et al. 1992). The small-scale event at Jake Ridge and similar areas that are not tributaries to Midway Valley could not impact the surface GROA due to topography.

The probable maximum precipitation provides the upper bound for precipitation events capable of occurring within the drainage basin that includes the surface GROA. The probable maximum precipitation is used to calculate the probable maximum flood. Engineered flood mitigation structures shown in SAR Figure 1.2.2-7 protect the surface GROA from inundation by the probable maximum flood from drainage areas upstream of the surface GROA. The probable maximum flood provides the upper bound for flows and inundation levels at the surface GROA. Therefore, any debris flow or mass-wasting event from drainage areas upstream of the surface GROA would be mitigated by the engineered flood mitigation structures designed for the probable maximum flood. Stormwater drainage diversion channels, sized to transport the probable maximum flood, are planned to protect the North Portal and the surface GROA from runoff and debris flows that could potentially emanate from the eastern slopes of Exile Hill. Subject to the requirement in the nuclear safety design basis that the ditches must be sized to the probable maximum flood, sizing and exact placement of these ditches will be determined during detailed design. Potential slope instability above the subsurface GROA, where steep terrain is a factor, would not impact the surface shaft pads and collars, as all are planned to be positioned on the top of ridges. As the initiating event of mass wasting or debris flows is either precluded from occurring by topography or is mitigated by engineered structures, the event sequence is prevented from occurring and has been screened from further consideration.

1.1 MASS WASTING EVENTS ON JAKE RIDGE AND AROUND MIDWAY VALLEY

SAR Section 1.1.7.2.1 describes a small-scale, storm-triggered debris flow on Jake Ridge that occurred 25 years ago and resulted in a mean depth of deposition of 16 cm of sediments on the lower hillslope. Jake Ridge is approximately 6 km from the surface GROA. The drainage basin in which Jake Ridge is located is not a tributary to Midway Valley where the surface GROA is located; therefore, a Jake Ridge event would have no impact on the surface GROA.

SAR Section 1.1.7.2.2 indicates that, since at least the beginning of the Holocene, storms have activated debris-flow stripping of the hillslopes around Midway Valley and that the sediment is carried onto the valley floor, resulting in a rising base level in Midway Valley. Debris-flow deposits are documented in the geologic record. However, these events are rare events, as is evidenced by the preservation of middle Pleistocene colluvium in the Yucca Mountain area and the lack of erosional scars on hillslopes (Coe et al. 1992), and they do not represent a hazard from drainage areas upstream of the surface GROA or at the subsurface GROA.

1.2 RUNOFF AND DEBRIS FLOWS FROM EXILE HILL

The majority of Exile Hill is composed of Tiva Canyon Tuff bedrock (either the crystal-rich (Tpcr) or crystal-poor member (Tpcp); see SAR Figure 1.1-64) that is competent and not readily erodible. Exile Hill has a small quantity of colluvial and alluvial cover near its base (SAR Figure 1.1-64). Where the colluvium and alluvium are present, the slopes are gently inclined compared to steeply dipping exposed bedrock (SAR Figure 1.1-64). Exile Hill is immediately west of the surface GROA and slopes at about 2.5H:lV (horizontal: vertical), or flatter, in its upper portion and flattens to about 6H:lV, or flatter, near its base adjacent to the west corner of the surface GROA. The steeper, upper portions of Exile Hill, west of the surface GROA, are composed of bedrock at the surface. Alluvium and colluvium constitute the flatter lower portion (SAR Figures 1.1-64 and 1.1-66). Due to the presence of bedrock in the upper portions and the flatness of the adjacent alluvial and colluvial portions, slope stability of Exile Hill is not a significant concern for the surface GROA (SAR Section 1.1.5.3.2.1).

Two stormwater drainage diversion channels, the north diversion ditch and the south diversion ditch, are planned to protect the North Portal and the surface GROA from runoff and debris flows that could emanate from the eastern slopes of Exile Hill that lie to the west of the North Portal pad (SAR Section 1.1.4.1.2.2). The response to RAI 2.2.1.1.1-002 transmitted *Geologic Repository Operations Area Aging Pad Site Plan* (BSC 2008a). This aging pad site plan shows the northern portion of the planned north diversion ditch. *Geologic Repository Operations Area North Portal Site Plan* (BSC 2008b) shows the remainder of the planned north diversion ditch and the entire planned south diversion ditch. The nuclear safety design basis (SAR Section 1.9, Table 1.9-6) requires that these man-made ditches be sized to transport the probable maximum flood. Subject to adherence to the nuclear safety design basis, sizing and exact placement of these ditches will be determined during detailed design.

2. COMMITMENTS TO NRC

None.

3. DESCRIPTION OF PROPOSED LA CHANGE

None.

4. REFERENCES

BSC (Bechtel SAIC Company) 2008a. *Geologic Repository Operations Area Aging Pad Site Plan.* 170-C00-AP00-00101-000 REV 00C. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080129.0005.

BSC 2008b. *Geologic Repository Operations Area North Portal Site Plan.* 100-C00-MGR0-00501-000 REV 00F. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080125.0007.

Coe, J.A.; Whitney, J.W.; and Glancy, P.A. 1992. "Photogrammetric Analysis of Modern Hillslope Erosion at Yucca Mountain, Nevada." *Abstracts with Programs, Geological Society of America, 24,* (7), A296. Boulder, Colorado: Geological Society of America. TIC: 224345.

RAI Volume 2, Chapter 2.1.1.3, Third Set, Number 8:

Provide the technical bases to demonstrate that potential hazards from nearby facilities, as documented in SAR Section 1.6.3.4.8 Nearby Industrial or Military Facility Accidents, were properly screened out. Also, provide information to demonstrate that the analyses are supported by current, up-to-date information. Specific examples include, but are not limited to:

- No rationale has been provided for the conclusion that ground motions at Yucca Mountain repository from nuclear tests at the repository would be bounded by moderate to large earthquakes in the region or the activities associated with the program to defeat military missions protected in tunnels and hardened deeply buried facilities would not affect the repository.
- No justification is provided for why an accidental detonation of the "maximum high explosive device" at the Device Assembly Facility or the tests performed at U-1a Complex/Lyner Complex or the tests with high explosives performed at the Big Explosives Experimental Facility would not initiate an event sequence at the repository.
- No basis is provided for the conclusion that the probability of an explosion in Area 27 complex is one in 10,000,000 per year.
- No justification is provided for why Storage and Disposition of Weapons-Usable Fissile Materials would not affect the repository.
- No basis is provided for the conclusion that the worst sequence from an accident at the Joint Actinide Shock Physics Experimental Research would be minor local contamination.
- Information provided for the Next Generation Radiographic and Magnetic Flux Compression Generation Facilities relies on a conceptual description in an environmental impact statement published in 1996.

1. RESPONSE

Industrial and military activities in the vicinity of the geologic repository operations area (GROA) were analyzed in *Industrial/Military Activity-Initiated Accident Screening Analysis* (BSC 2008). The purpose of this analysis is to determine if activities, hazards, or accidents at industrial or military facilities in the vicinity of the repository may result in event sequences that produce radiological exposures to workers or offsite individuals during the preclosure period. This analysis only considers issues related to preclosure radiological safety. Specifically, industrial and military activities that meet the NUREG-0800 (NRC 2007) Sections 2.2.1 and 2.2.2 proximity criteria are evaluated for potential hazards that could lead to event sequences. The NUREG-0800 guidance states that all industrial and military facilities and activities within five miles be reviewed. NUREG-0800 also specifies that facilities and activities at greater distances be considered if they have the potential to affect plant safety-related features.

SAR Figure 1.1-6 (reproduced as Figure 1) shows the location of the repository site. A five-mile radius has been drawn around the surface GROA centered on the repository North Portal. This figure illustrates that the activities discussed in this RAI are substantially outside of the five-mile radius and are within the area of the Nevada test Site (NTS) that is East and North of the site, as described in SAR Section 1.1.1.

The most up-to-date references available at the time of publication of the *Industrial/Military Activity-Initiated Accident Screening Analysis* (BSC 2008) were used to evaluate activities and potential hazards. The two principal sources of information used to evaluate site activities for impacts to the surface GROA were *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (NTS EIS) (DOE 1996) and *Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (2002 NTS SA) (DOE 2002). The NTS EIS (DOE 1996) examined the impacts from operations at the NTS and other Nevada locations over a ten-year period. In 2002, the National Nuclear Security Administration (NNSA) Nevada Site Office conducted a five-year review of the NTS EIS (DOE 1996), documented in the 2002 NTS SA (DOE 2002). The NNSA Nevada Site Office found that there were no substantial changes from the NTS EIS (DOE 1996) and no significant new circumstances or information relevant to environmental concerns. Projects and activities introduced since the NTS EIS (DOE 1996) or proposed for the next five years were reviewed.

Draft Supplemental Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (2008 Draft NTS SA) (DOE 2008) was released in April 2008, after the completion of the Yucca Mountain SAR. As with the 2002 NTS SA (DOE 2002), projects and activities that were within the baseline set in the NTS EIS (DOE 1996) did not require further analysis by the NNSA; those potentially outside the baseline were analyzed further. A review of the 2008 Draft NTS SA (DOE 2008) indicates that none of the identified activities and missions change the conclusions presented in *Industrial/Military Activity-Initiated Accident Screening Analysis* (BSC 2008).

1.1 CONSIDERATION OF GROUND MOTIONS FROM NUCLEAR TESTS OR ACTIVITIES ASSOCIATED WITH THE PROGRAM TO DEFEAT OTHER MILITARY MISSIONS

- No rationale has been provided for the conclusion that ground motions at Yucca Mountain repository from nuclear tests at the repository would be bounded by moderate to large earthquakes in the region or the activities associated with the program to defeat military missions protected in tunnels and hardened deeply buried facilities would not affect the repository.

Data and associated analyses demonstrate that ground motions at Yucca Mountain from nuclear tests have been at levels lower than would be expected from moderate to large earthquakes in the region.

The potential impact from underground nuclear weapons testing includes ground motions imparted to the region during such a test. In *Summary of Ground Motion Prediction Results for Nevada Test Site Underground Nuclear Explosions Related to the Yucca Mountain Project*

(Walck 1996), data on ground motions from underground nuclear explosions recorded on and near the NTS, with emphasis on the ground motions recorded at stations on Yucca Mountain, are summarized. Ground motion data from NTS explosions over a period from 1977 through 1990 were collected and analyzed. The data and associated analyses demonstrate that ground motions at Yucca Mountain from nuclear tests have been at levels lower than would be expected from moderate to large earthquakes in the region (Walck 1996). Thus, nuclear tests would not be the controlling factor in development of repository seismic criteria; nuclear testing is conservatively represented by the spectrum of earthquakes considered in the design of the repository and embodied in the nuclear safety design bases of SAR Section 1.9.

Section 6.3.1.5.8 of *Industrial/Military Activity-Initiated Accident Screening Analysis* (BSC 2008) describes the activities associated with the Defense Threat Reduction Agency (DTRA) Hard Target Defeat Tunnel Program. The tunnels to be potentially used in this agency's test activities are located in Area 16, approximately 15 miles from the surface GROA. The ground motions and overpressures generated by these nonnuclear tests would not affect the surface GROA facilities due to the distance and topography separating these areas. Overpressures generated by explosions or tests at these facilities will have dissipated to below 1 psi prior to reaching the surface GROA facilities.

1.2 JUSTIFICATION FOR WHY HIGH EXPLOSIVES DETONATIONS DO NOT INITIATE AN EVENT SEQUENCE

- No justification is provided for why an accidental detonation of the "maximum high explosive device" at the Device Assembly Facility or the tests performed at U-1a Complex/Lyner Complex or the tests with high explosives performed at the Big Explosives Experimental Facility would not initiate an event sequence at the repository.

Overpressures or secondary seismic effects generated by an explosion or test at the Device Assembly Facility, the U-1a Complex, and the Big Explosives Experimental Facility will have dissipated prior to reaching the surface GROA. Therefore, they would not generate an event sequence.

The hazards associated with the Device Assembly Facility, the U-1a Complex, and the Big Explosives Experimental Facility are presented in Sections 6.3.1.1.4, 6.3.1.1.7, and 6.3.1.1.8, respectively, of *Industrial/Military Activity-Initiated Accident Screening Analysis* (BSC 2008). The locations of these facilities are presented in Figure 1. The Device Assembly Facility, U-1a Complex, and the Big Explosives Experimental Facility are approximately 25 miles, 23 miles, and 21 miles from the surface GROA, respectively. There are mountains and hills of varying heights that separate the surface GROA from these complexes, as seen in Figure 1. As demonstrated by the results of calculations in Section 6.5 of *Industrial/Military Activity-Initiated Accident Screening Analysis* (BSC 2008), overpressures generated by explosions or tests at these facilities will have dissipated to below 1 psi prior to reaching the surface GROA facilities. Results from the calculation in Section 6.5 of *Industrial/Military Activity-Initiated Accident Screening Analysis* (BSC 2008) demonstrate that a TNT-equivalent mass of 1.3×10^{10} pounds mass of TNT would be required to exceed the safe distance overpressure of 1 psi at a distance of

20 miles. To put this mass into perspective, the thermonuclear blast that created the Sedan Crater (1,280 ft in diameter, 320 ft deep) in Area 10 was rated at 104 kilotons, which is approximately the same TNT-equivalent mass required to exceed the five-mile safe distance (2.0×10^8 pounds mass of TNT). This quantity significantly exceeds the TNT-equivalent inventories currently associated with NTS facilities and any transportation or industrial explosive sources, and is highly likely to exceed any future TNT-equivalent inventories (BSC 2008). In addition, Section 5 of the NTS EIS (DOE 1996) states that beyond 4.8 to 9.7 km (3 to 6 mi) of the largest underground nuclear explosion (greater than 1 megaton), there was no evidence of significant secondary seismic effects associated with the test. The distance from these potential explosion sites and the GROA far exceeds six miles.

Therefore, the hazards associated with detonations or tests performed at these facilities were screened out based on distance and topography. An explosion or test at any of these facilities would not initiate an event sequence.

1.3 PROBABILITY OF EXPLOSION IN AREA 27

- No basis is provided for the conclusion that the probability of an explosion in Area 27 complex is one in 10,000,000 per year.

The basis for the conclusion that the probability of an explosion in Area 27 complex is one in ten million per year is found in the NTS EIS (DOE 1996). Section 5 of the NTS EIS (DOE 1996) presents an analysis of the impacts of past, current, and potential future programs at the NTS. The maximum reasonably foreseeable Area 27 accident would be a nonnuclear explosion involving high explosives in a nuclear weapons storage bunker, which has a probability of occurrence of 1×10^{-7} (1 in 10,000,000) per year (DOE 1996, Section 5.1.1.11). Details associated with this analysis are presented in *Human Health Risk Analysis,* which is Attachment A to Appendix H of the NTS EIS (DOE 1996).

1.4 EFFECT OF STORAGE AND DISPOSITION OF WEAPONS-USABLE FISSILE MATERIALS

- No justification is provided for why Storage and Disposition of Weapons-Usable Fissile Materials would not affect the repository.

Storage and disposition of weapons-usable fissile material would not affect the repository because; (a) these materials will not be permanently stored at the NTS, and (b) when they are temporarily located at the NTS, the location is too far away to affect the GROA (see Section 1.2). The 2002 NTS SA (DOE 2002) states that the Weapons-Usable Fissile Material EIS Record of Decision did not select the NTS as the location for this mission. This decision has not changed.

Limited nuclear weapons dismantlement activities and interim storage of nuclear weapons and components will take place at the Device Assembly Facility. However, the plutonium pits and highly enriched uranium will not be permanently stored at the NTS. They will be stored until they can be transferred to another NNSA complex site (DOE 2008, Section 3.1.1.2). The interim storage and disposition of weapons-usable fissile materials would occur at the Device Assembly Facility, which is approximately 25 miles from the GROA. This activity would not pose a threat to the repository because of distance and intervening topography. Hazards associated with the Device Assembly Facility are discussed in Section 1.2. It should be noted that since the hazards associated with a nuclear weapon cannot impact the GROA, the hazards associated with any part or component of the weapon will not impact the GROA.

1.5 EFFECTS OF AN ACCIDENT AT THE JOINT ACTINIDE SHOCK PHYSICS EXPERIMENTAL RESEARCH FACILITY

- No basis is provided for the conclusion that the worst sequence from an accident at the Joint Actinide Shock Physics Experimental Research would be minor local contamination.

The basis for the conclusion in *Industrial/Military Activity-Initiated Accident Screening Analysis* (BSC 2008) that the worst sequence from an accident at the Joint Actinide Shock Physics Experimental Research (JASPER) facility would be minor local contamination is provided in the 2002 NTS SA (DOE 2002). This conclusion, as described in the 2002 NTS SA (DOE 2002), is reached in an analysis titled *JASPER Hazards Analysis Report* (LLNL 2000).

As described in Section 6.3.1.1.6 of *Industrial/Military Activity-Initiated Accident Screening Analysis* (BSC 2008), the JASPER facility conducts shock physics experiments on special nuclear materials and other actinide materials using a two-stage, light–gas gun to shoot projectiles at target materials. The 2002 NTS SA (DOE 2002, p. 5-4) states that the worst possible consequence to the environment (from a variety of extremely unlikely initiating events) would be minor local contamination. Since the JASPER facility is approximately 18 miles from the surface GROA (see Figure 1), the conclusion was made in Section 6.3.1.1.6 of *Industrial/Military Activity-Initiated Accident Screening Analysis* (BSC 2008) that the risks to the repository would be negligible for activities or events that occur at the JASPER facility.

1.6 DESCRIPTION OF THE NEXT GENERATION RADIOGRAPHIC AND MAGNETIC FLUX COMPRESSION GENERATION FACILITIES

- Information provided for the Next Generation Radiographic and Magnetic Flux Compression Generation Facilities relies on a conceptual description in an environmental impact statement published in 1996.

As described in Section 6.3.1.1.14 of *Industrial/Military Activity-Initiated Accident Screening Analysis* (BSC 2008), the Next Generation Radiographic Facility (Advanced Hydrotest Facility) and the Magnetic Flux Compression Generation Facility were proposed facilities (not yet constructed or operational) that were described in the NTS EIS (DOE 1996). It was proposed that the Magnetic Flux Compression Generation Facility could be located at the Big Explosives Experimental Facility. At that time, it was anticipated that these facilities would be sited within the next ten years. For this reason, these facilities were conservatively included in *Industrial/Military Activity-Initiated Accident Screening Analysis* (BSC 2008). Since these are proposed (but not yet sited) facilities, the information in the NTS EIS (DOE 1996) was the most current information available.

In the 2002 NTS SA (DOE 2002, Section 3.1.1.2), the Advanced Hydrotest Facility is again mentioned as a potential future project at the NTS. Although not mentioned by name, one of the capabilities of the Magnetic Flux Compression Generation Facility (to provide high-explosives pulsed power) is included as one of the capabilities of the Big Explosives Experimental Facility. It states that the Big Explosives Experimental Facility is capable of up to a 70,000-pound-TNT-equivalent physics experiment providing for the study and investigation of explosive characteristics, impacted materials, and high-explosives pulsed power.

In *Draft Complex Transformation SPEIS* (DOE 2008, Section 3.1.1.3) the NTS is identified as an alternative site for various activities, including consolidated hydrotesting; this is the activity previously proposed in the NTS EIS (DOE 1996) and the 2002 NTS SA (DOE 2002) as the Advanced Hydrotest Facility. The hazards associated with this activity would be the same as those associated with the hydrotest capability of the Big Explosives Experimental Facility.

The 2008 Draft NTS SA (DOE 2008) also states that the Big Explosives Experimental Facility has been modified to perform high explosives pulsed-power experiments. However, the 2008 Draft NTS SA (DOE 2008) states that the modifications at the Big Explosives Experimental Facility will not result in an increase in the potential size of detonations or change the amount or types of materials involved in detonation beyond those analyzed in the NTS EIS (DOE 1996). The Big Explosives Experimental Facility is designed and certified with an operational high explosive limit of 70,000 pounds (TNT equivalent). Hazards associated with the Big Explosives Experimental Facility are discussed in Section 1.2. The hazards associated with detonations or tests performed at the Big Explosives Experimental Facility were screened out based on distance and topography. An explosion or test at the Big Explosives Experimental Facility would not initiate an event sequence. Overpressures generated by explosions or tests at this facility will have dissipated to below 1 psi prior to reaching the surface GROA facilities.

1.7 CONCLUSION

As described in *Industrial/Military Activity-Initiated Accident Screening Analysis* (BSC 2008), there are currently no existing or planned military or industrial activities (including the facilities and activities addressed in this RAI) that might be expected to produce event sequences during the preclosure period of the repository. This analysis was supported by the most up-to-date and current information available, as discussed in Section 1.

2. COMMITMENTS TO NRC

None.

3. DESCRIPTION OF PROPOSED LA CHANGE

None.

4. REFERENCES

BSC (Bechtel SAIC Company) 2008. *Industrial/Military Activity-Initiated Accident Screening Analysis*. 000-PSA-MGR0-01500-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080204.0006.

DOE (U.S. Department of Energy) 1996. *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada*. DOE/EIS 0243. Las Vegas, Nevada: U.S. Department of Energy, Nevada Operations Office. ACC: MOL.20010727.0190; MOL.20010727.0191.

DOE 2002. *Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada*. DOE/EIS-0243-SA-01. Las Vegas, Nevada: U.S. Department of Energy, National Nuclear Security Administration, Nevada Operations Office. ACC: MOL.20030409.0001.

DOE 2006. *DRAFT December 2006 Revised Environmental Assessment. Large Scale, Open-Air Explosive Detonation DIVINE STRAKE at the Nevada Test Site*. DOE/EA-1550. Las Vegas, Nevada: U.S. Department of Energy, National Nuclear Security Administration, Nevada Site Office. Cooperating Agency: Department of Defense, Defense Threat Reduction Agency.

DOE 2008. *Draft Supplemental Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada*. DOE/EIS-0243-SA-03. Las Vegas, Nevada: U.S. Department of Energy, National Nuclear Security Administration, Nevada Operations Office. ACC: MOL.20080513.0176.

LLNL (Lawrence Livermore National Laboratory) 2000. *JASPER Hazard Analysis Report.* JAS-RPT-11/UCRL-LR-136127. August 2000.

NRC (U.S. Nuclear Regulatory Commission) 1978. Regulatory Guide 1.91, Rev. 1. *Evaluations of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants.* Washington, D.C.: U.S. Nuclear Regulatory Commission. TIC: 2774.

NRC 2007. "Identification of Potential Hazards in Site Vicinity." Section 2.2.1–2.2.2 of Standard Review Plan. NUREG-0800, Rev. 3. Washington, D.C.: U.S. Nuclear Regulatory Commission. ACC: MOL.20071017.0181.

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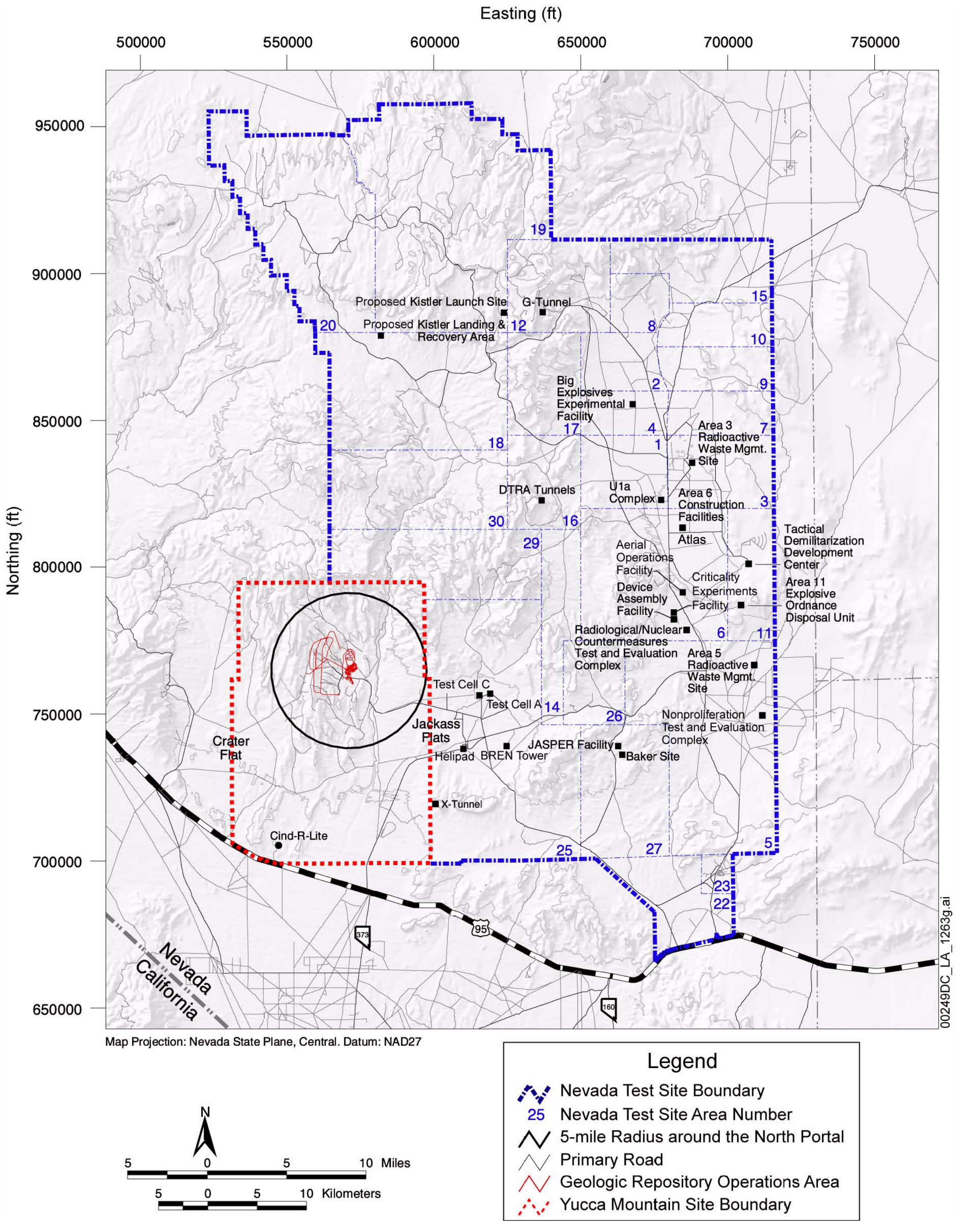

Figure 1. Industrial, Commercial, and Military Facilities and Activities in Proximity to Yucca Mountain (SAR Figure 1.1-6)

RAI Volume 2, Chapter 2.1.1.3, Third Set, Number 15:

(a) Confirm that all of the supporting files for the SAR were completed. Explain the comments in File "000-PSA-MGR0-00900-000a09-Mar-11-2008.xls" included in Attachment H to BSC, 2008j:

- On tab, "Data Page," with reference to, "TC w/UCSNF," a note indicates, "changed Feb 26, per MVF, Waiting for documentation that UCSNF comes in only on TT."
- On tab, "ESD01," a box indicates, "No UCSNF on Railcars," and a note indicates, "Pending referencable documentation that states UCSNF arrives only on truck trailers."

(b) For the SAPHIRE files provided as Attachment H to BSC, 2008h (and similar documents), explain which ones are applicable to the review and confirm that work has been completed on the SAPHIRE models in particular for files having the word, "Draft" in their title. Some examples follow:

- The SAPHIRE files for the IHF include, "IHF FOR LA.SRA" and "IHF.SRA."
- The SAPHIRE files for Intrasite fault trees include, "intrasite Oct 07.sra" and "INTRASITE-FEB-08.SRA."
- The SAPHIRE files for the WHF include, "WHF – Vol. II Draft.sra" and "WHF--- VOL-II-DRAFT.SRA."
- The SAPHIRE files for the Subsurface include, "FaultTreesCRCF.sra" and "YUCCA-MOUNTAIN.SRA."

1. RESPONSE

1.1 COMMENTS INCLUDED IN EXCEL FILES IN ATTACHMENT H

During the preparation of the preclosure safety analysis (PCSA) analyses, comments were added in some Excel files to clarify various points, to identify concepts of the spreadsheet and, in some cases, to provide a reminder to the analyst. However, after the addition of these comments, each analysis was completed and the overall technical content of the Excel files (including these comments) verified by checking and review in accordance with established procedures. As the comments do not contribute to or control Excel functions, the comments do not compromise the numerical results obtained in the preclosure safety analyses. Therefore, the results of the Excel files provided in Attachment H of each PCSA event sequence categorization analysis [e.g., *Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis* (BSC 2008a)] are complete and accurate.

The two comments identified in the RAI are from *Intra-Site Operations and BOP Reliability and Event Sequence Categorization Analysis* (BSC 2008b). The first comment states: “Changed Feb 26, per MVF. Waiting for documentation that UCSNF comes in only on TT.” This comment means that the uncanistered commercial spent nuclear fuel (UCSNF) waste forms will arrive only by truck trailer (TT). This direction was confirmed by subsequent information, as indicated in Table 6.3-10 of the categorization analysis (BSC 2008b) under basic event, UCSNF_RC. The basic event states that the number of transportation casks containing UCSNF on railcars is zero (i.e., all uncanistered commercial spent nuclear fuel will arrive by truck). *Waste Form Throughputs for Preclosure Safety Analysis* (BSC 2007) is used in the analysis as a supporting reference. The second comment repeats the same concept as the first and states, “Pending referencable [sic] documentation that states UCSNF arrives only on truck trailers.” This reference was obtained as indicated in the categorization analysis (BSC 2008b, Table 6.3-10) with the supporting documentation found in *Waste Form Throughputs for Preclosure Safety Analysis* (BSC 2007).

To provide a comprehensive response, all comments in Excel files in Attachment H pertaining to the event sequence categorization analyses (i.e., BSC 2008a, BSC 2008b, BSC 2008c, BSC 2008d, BSC 2008e, and BSC 2008f) were identified and are listed in Table 1. These comments were reviewed for potential impact on the final result of the analyses. The majority of the comments provide the bases for the entries in the Excel file. In cases where the comment suggests an additional action, it was verified that the action was completed prior to the finalization of the analysis, or that the comment is no longer relevant as shown in the footnotes to Table 1. No comment was determined to adversely impact the final results provided in these files, and the Excel files are complete and accurate as provided.

1.2 FILES CONTAINING THE TERM “DRAFT” IN ATTACHMENTS

In Attachment H of several event sequence categorization analyses, remnants of the analysis process (i.e., temporary and draft files) were inadvertently included. These files were superseded during the analysis effort and do not compromise or limit the results of the analyses, nor do they impact safety-related conclusions in the SAR. The analyses provided in these documents were completed, and the final versions checked, reviewed, and approved in accordance with established procedures.

As to the existence of these files, the SAPHIRE computer code does not automatically delete extraneous or unused files when an analysis run is completed. For example, when combining two SAPHIRE projects into a single model[1], duplicate “.SRA” files can occur. In addition, other files that have no bearing on the analysis (such as temporary file names starting with “~”) may also be present. When the analysis for each facility was completed, the entire working file directory (including these remnants) was included in the attachment to provide a comprehensive documentation of the work.

[1] The term “model” or “project” is used in the response to describe a SAPHIRE computer analysis (with the files contained in a single directory) that simulates a particular system.

As noted in *Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE) Vol. 3 Code Reference Manual—Part A* (Woods et al. 2008), files with the extension ".SRA" are created automatically by the SAPHIRE code when starting a new project or model. Such files are typically empty in these PCSA analyses (i.e., with a 0 kb file size), but are required for use of the developed model. When several projects are used for a single facility, a ".SRA" file will be created for each project. This is the case for the Wet Handling Facility and the Receipt Facility, where separate SAPHIRE projects were created, with resulting ".SRA" files created in the separate directories established for each project. Combining separate analyses from two differing directories into a single directory (as was done for some PCSA analyses) can result in an extra ".SRA" file. Testing of the SAPHIRE projects in the PCSA attachments with duplicate ".SRA" files indicates that the extra ".SRA" file has no effect on the final results, and either file can be employed to start a SAPHIRE project analysis.

Also contained in some file directories are temporary computation files (i.e., file names beginning with "~"). These files are the result of an abrupt termination of the SAPHIRE operation during an analysis (such as due to a loss of power). These temporary files (if used in subsequent computations) are overwritten by SAPHIRE; otherwise, the files are not used by the SAPHIRE code. Therefore, the presence of either duplicate ".SRA" files or the temporary files has no impact on the final SAPHIRE results and no impact on the SAR conclusions.

In some cases, temporary files were created by the analyst as indicated by nomenclature. In a limited number of instances, the analyst used the word "draft" in constructing a filename. For example, this occurs for files in Attachment H for the Wet Handling Facility event sequence analysis (BSC 2008f). In specific instances, however, these files are the files of record for the analysis and directly support the PCSA described in the license application.

The presence of temporary or draft files in Attachment H was reviewed in the following similar documents:

- *Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis* (BSC 2008a)
- *Intra-Site Operations and BOP Reliability and Event Sequence Categorization Analysis*, (BSC 2008b)
- *Initial Handling Facility Reliability and Event Sequence Categorization Analysis*, (BSC 2008c)
- *Receipt Facility Reliability and Event Sequence Categorization Analysis*, (BSC 2008d)
- *Subsurface Operations Reliability and Event Sequence Categorization Analysis*, (BSC 2008e)
- *Wet Handling Facility Reliability and Event Sequence Categorization Analysis*, (BSC 2008f).

Unnecessary SAPHIRE computation files or temporary computation files (i.e., starting with "~") identified in Attachment H for these analyses are listed in Table 2, including the duplicate ".SRA" files as noted in the RAI. Also included in this table are temporary files which have the word "draft," "dummy," or "copy of" in the file name, and which are not needed for the SAPHIRE project. The files in Table 2 are considered extraneous to the PCSA results provided.

In addition, Attachment H to the listed event sequence categorization analyses also contains output and documentation files which are not necessary to document the SAPHIRE model. Specifically, various graphic output files from SAPHIRE (i.e., files with extensions *.emf*, *.wmf*, *.jpg*, or *.png*) and SAPHIRE internal files used to produce such graphical output (i.e., files with extensions *.DLS* and *.ETG*) are present. Further, the attachments also contain text files (i.e., files with extensions *.doc*, *.txt*, or *.rtf*) used to summarize intermediate output. Neither the graphics files nor the text files are an intrinsic part of the SAPHIRE analyses of record described in the license application and are therefore unnecessary. These files, however, are not included in Table 2, except when identified as a temporary file as discussed earlier.

In summary, the files in Table 2 and graphics and text files included as part of Attachment H to the listed event sequence categorization analyses are not necessary to support PCSA analyses. The remaining files in Attachment H of the categorization analyses do support the PCSA analyses of record as described in the license application are complete.

2. COMMITMENTS TO NRC

None.

3. DESCRIPTION OF PROPOSED LA CHANGE

None.

4. REFERENCES

BSC (Bechtel SAIC Company) 2007. *Waste Form Throughputs for Preclosure Safety Analysis*. 000-PSAMGR0-01800-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20071106.0001.

BSC 2008a. *Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis*. 060-PSA-CR00-00200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080311.0031.

BSC 2008b. *Intra-Site Operations and BOP Reliability and Event Sequence Categorization Analysis*. 000-PSA-MGR0-00900-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080312.0032.

BSC 2008c. *Initial Handling Facility Reliability and Event Sequence Categorization Analysis*. 51A-PSA-IH00-00200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080312.0031.

BSC 2008d. *Receipt Facility Reliability and Event Sequence Categorization Analysis*. 200-PSA-RF00-00200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080312.0030.

BSC 2008e. *Subsurface Operations Reliability and Event Sequence Categorization Analysis*. 000-PSA-MGR0-00500-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080312.0034.

BSC 2008f. *Wet Handling Facility Reliability and Event Sequence Categorization Analysis*. 050-PSA-WH00-00200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080312.0033.

Wood, S.T.; Smith, C.L.; Kvarfordt, K.L.; and Beck, S.T. 2008. *Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE) Vol. 3 Code Reference Manual—Part A*. NUREG/CR-6952. Washington, D.C.: U.S. Nuclear Regulatory Commission.

Table 1. Comments Identified within Excel files in Attachment H to PCSA Analyses

Filename	Comment
***Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis* (BSC 2008a)**	
CRCF Fire Frequency - No Suppression jwm.xls	Ignition frequency based on floor area by category.
	Count of total 'points' in each category for all rooms.
	Category Frequency divided by category population
	The upper 97.5% confidence interval value
	100 points for each internal combustion engine.
	The upper 97.5% confidence interval value
	This table used for Initiating Event Frequency analyses
	Includes only rooms that contain the Waste Form while it is vulnerable.
	Fires that propagate through part of the room, all of the room, or throughout the fire-rated area all contribute to threatening the target.
	Fires that propagate through part of the room, all of the room, or throughout the fire-rated area all contribute to threatening the target.
	Target Exposure Time (minutes)/Preclosure Period (minutes)
	While the waste package is vulnerable, room 1018 will be open to rooms 2004 and 2007.
	Full area of room 1018
	During vulnerability room 1015 will be open to room 1014.
	Identical operations occur in room 1024. The number of casks through room 1023 is doubled to represent both rooms.
	Identical operations occur in room 1024. The number of casks through room 1023 is doubled to represent both rooms.
	Rooms are treated as one because the door between them is open during the vulnerability.
	Rooms are treated as one because the door between them is open during the vulnerability.
	Rooms are treated as one because the door between them is open during the vulnerability.
	The movement of the Site Transporter includes most of the floor area of the room, all equipment 'close.'
	The movement of the Site Transporter includes most of the floor area of the room, all equipment 'close.'
	The movement of the Site Transporter includes most of the floor area of the room, all equipment 'close.'

Table 1. Comments Identified within Excel files in Attachment H to PCSA Analyses (Continued)

Filename	Comment
CRCF Fire Frequency - No Suppression jwm.xls (Continued)	The movement of the Site Transporter includes most of the floor area of the room, all equipment 'close.'
	The movement of the Site Transporter includes most of the floor area of the room, all equipment 'close.'
	Fire zone drawings for the current CRCF G.A. not available. Adapted from older drawings. [b]
	Any fire that spreads beyond a fire-rated area boundary or is deemed to contribute to the large fire frequency.
Initial Handling Facility Reliability and Event Sequence Categorization Analysis **(BSC 2008c)**	
IHF Fire Frequency - no suppression.xls	Ignition frequency based on floor area by category.
	Count of total 'points' in each category for all rooms.
	Category Frequency divided by category population
	The upper 97.5% confidence interval value
	100 points for each internal combustion engine.
	The upper 97.5% confidence interval value
	This table used for Initiating Event Frequency analyses
	Includes only rooms that contain the Waste Form while it is vulnerable.
	Fires that propagate through part of the room, all of the room, or throughout the fire-rated area all contribute to threatening the target.
	Fires that propagate through all of the room or throughout the fire-rated area both contribute to threatening the target.
	Target Exposure Time (minutes)/Preclosure Period (minutes)
	Target Exposure Time (minutes)/Preclosure Period (minutes)
	WP Carriage Retrieval Assembly (vulnerability) runs entire length of room. All numbers are 'at target'
	WP Carriage Retrieval Assembly (vulnerability) runs entire length of room. All numbers are 'at target'
	WP Carriage Retrieval Assembly (vulnerability) runs entire length of room. All numbers are 'at target'
	WP Carriage Retrieval Assembly (vulnerability) runs entire length of room. All numbers are 'at target'
	WP Carriage Retrieval Assembly (vulnerability) runs entire length of room. All numbers are 'at target'
	WP Carriage Retrieval Assembly (vulnerability) runs entire length of room. All numbers are 'at target'

Table 1. Comments Identified within Excel files in Attachment H to PCSA Analyses (Continued)

Filename	Comment
IHF Fire Frequency - no suppression.xls (Continued)	TEV runs entire length of room. All numbers are 'at target'
	TEV runs entire length of room. All numbers are 'at target'
	TEV runs entire length of room. All numbers are 'at target'
	TEV runs entire length of room. All numbers are 'at target'
	TEV runs entire length of room. All numbers are 'at target'
	TEV runs entire length of room. All numbers are 'at target'
	FA-00-05 (room 1006) will be open to room 2004 for the duration of WP vulnerability. They are treated as a single room. Propagation from FA-00-02 is considered because 2004 is in FA-00-02.
	FA-00-06 (room 1007) will be open to room 2005 for the duration of WP vulnerability. They are treated as a single room. Propagation from FA-00-02 is considered because 2005 is in FA-00-02.
	Most of FA-00-02 is a single, large open room, and so is treated as such in the model. This includes Areas 1002, 1009, 1012, 2003, and 2005.
	Most of FA-00-02 is a single, large open room, and so is treated as such in the model. This includes Areas 1002, 1009, 1012, 2003, and 2005. The waste form is vulnerable when it is in 2005.
	Accounts for the running length of the railcar
	Most of FA-00-02 is a single, large open room, and so is treated as such in the model. This includes Areas 1002, 1009, 1012, 2003, and 2005. The waste form is vulnerable when it is in 2005.
	Accounts for the running length of the railcar
	Most of FA-00-02 is a single, large open room, and so is treated as such in the model. This includes Areas 1002, 1009, 1012, 2003, and 2005. The waste form is vulnerable when it is in 2005.
	Any fire that spreads beyond a fire-rated area boundary or is deemed to contribute to the large fire frequency.
***Receipt Facility Reliability and Event Sequence Categorization Analysis* (BSC 2008c)**	
RF Fire Frequency_NoSuppression.xls	Ignition frequency based on floor area by category.
	Count of total 'points' in each category for all rooms.
	Category Frequency divided by category population
	The upper 97.5% confidence interval value
	100 points for each internal combustion engine.
	The upper 97.5% confidence interval value

Table 1. Comments Identified within Excel files in Attachment H to PCSA Analyses (Continued)

Filename	Comment
	This table used for Initiating Event Frequency analyses
RF Fire Frequency_NoSuppression.xls (Continued)	Includes only rooms that contain the Waste Form while it is vulnerable.
	Fires that propagate through part of the room, all of the room, or throughout the fire-rated area all contribute to threatening the target.
	Fires that propagate through all of the room or throughout the fire-rated area both contribute to threatening the target.
	Target Exposure Time (minutes)/Preclosure Period (minutes)
	Target Exposure Time (minutes)/Preclosure Period (minutes)
	Target Exposure Time (minutes)/Preclosure Period (minutes)
	Target Exposure Time (minutes)/Preclosure Period (minutes)
	During vulnerablility, room 1001 will be open to room 1002.
	During vulnerablility, the listed rooms will be open to each other.
	During vulnerablility, the listed rooms will be open to each other.
	Rooms 1017 and 1017A are open to each other.
	Rooms 1015 and 2007 are open to each other.
	Any fire that spreads beyond a fire-rated area boundary or is deemed to contribute to the large fire frequency.
***Intra-Site Operations and BOP Reliability and Event Sequence Categorization Analysis* (BSC 2008b)**	
000-PSA-MGR0-00900-000a09-Mar-11-2008.xls	Copy and paste-in values from PEFA Chart
	Per Phuoc Le, this is for a 3-ft drop of the AO
	Using 1E-5 value results in Cat 2 for RRU in ESD02/TADs
	No TADs will come via truck trailer (refer to SAR)
	Changed Feb 26, per MVF. Waiting for documentation that UCSNF comes in only on TT [c]
	Pending referencable documentation that states UCSNF arrives only on truck trailers [d]
	Shape of room required splitting the room into two
	Shape of room required splitting the room into two

Table 1. Comments Identified within Excel files in Attachment H to PCSA Analyses (Continued)

Filename	Comment
Shock wave dissipationR1.xls	GOALS 1) Determine a real standoff distance for 120,000 gal tanks 2) Determine a real standoff distance for tanker trucks (assume 20,000 gal)
	X is standoff distance

Table 1. Comments Identified within Excel files in Attachment H to PCSA Analyses (Continued)

Filename	Comment
***Wet Handling Facility Reliability and Event Sequence Categorization Analysis* (BSC 2008f)**	
WHF Fire Frequency_No Suppression.xls	Ignition frequency based on floor area by category.
	Count of total 'points' in each category for all rooms.
	Category Frequency divided by category population
	The upper 97.5% confidence interval value
	100 points for each internal combustion engine.
	The upper 97.5% confidence interval value
	This table used for Initiating Event Frequency analyses
	Includes only rooms that contain the Waste Form while it is vulnerable.
	Fires that propagate through part of the room, all of the room, or throughout the fire-rated area all contribute to threatening the target.
	Fires that propagate through all of the room or throughout the fire-rated area both contribute to threatening the target.
	Target Exposure Time (minutes)/Preclosure Period (minutes)
	Target Exposure Time (minutes)/Preclosure Period (minutes)
	Target Exposure Time (minutes)/Preclosure Period (minutes)
	During vulnerability, rooms 1001, 1016, B001, B007, and B009 are open to each other.
	During vulnerability, rooms 1001, 1016, B001, B007, and B009 are open to each other.
	During vulnerability, rooms 1016, B001, B007, and B009 are open to each other.
	During vulnerability, rooms 1016, B001, B007, and B009 are open to each other.
	During vulnerability, room 1008 is open to 2004 for CTM operations.
	During vulnerability, rooms 1016, B001, B007, and B009 are open to each other.
	During vulnerability, rooms 1016, B001, B007, and B009 are open to each other.
	During vulnerability, room 1007 is open to 2004 due to CTM operations.
	Fire zone drawings for the current CRCF G.A. not available. Adapted from older drawings. [b]

Table 1. Comments Identified within Excel files in Attachment H to PCSA Analyses (Continued)

Filename	Comment
	Any fire that spreads beyond a fire-rated area boundary or is deemed to contribute to the large fire frequency.
EXCEL Files Included in All PCSA Categorization Analyses [a]	
Creep rupture - Slow Heatup 0.5 inch.xls	0.5 inches is the minimum thickness.
	Uncertainty distribution derived from review of transportation cask SARs.
	This value comes from the separate canister heatup analysis. Value shown is typical of the long duration intense fires for which failure could occur.
	Fraction of the percentage change in canister temperature that corresponds to change in gas temperature. Example: if value is 0.5 and the canister temperature doubles, then the gas temperature increases by 50%. Value of 0.5 is conservative. for bare canister case; 1.0 is conservative for canister inside WP or cask.
	Pressure increases as canister temperature increases. Temperature of gas estimated based on separate heat transfer analyses.
	Multiplier for for flow stress - standard deviation of 0.038.
	Currently set based on the tube diameter.
	Equal to k*(ys + us) where ys = yield strength and us = ultimate strength. For SS316, approx equal 0.7*ultimate.
	Multiplier for for flow stress - standard deviation of 0.038.
	Currently set based on the tube diameter.
	Fraction of the percentage change in canister temperature that corresponds to change in gas temperature. Example: if value is 0.5 and the canister temperature doubles, then the gas temperature increases by 50%. Value of 0.5 is conservative.
	Equal to k*(ys + us) where ys = yield strength and us = ultimate strength. For SS316, approx equal 0.7*ultimate.
Creep rupture - Slow Heatup 1 inch.xls	0.5 inches is the minimum thickness.
	Uncertainty distribution derived from review of transportation cask SARs..
	This value comes from the separate canister heatup analysis. Value shown is typical of the long duration intense fires for which failure could occur.
	Fraction of the percentage change in canister temperature that corresponds to change in gas temperature. Example: if value is 0.5 and the canister temperature doubles, then the gas temperature increases by 50%. Value of 0.5 is conservative. for bare canister case; 1.0 is conservative for canister inside WP or cask.

Table 1. Comments Identified within Excel files in Attachment H to PCSA Analyses (Continued)

Filename	Comment
	Pressure increases as canister temperature increases. Temperature of gas estimated based on separate heat transfer analyses.
Creep rupture - Slow Heatup 1 inch.xls (Continued)	Multiplier for for flow stress - standard deviation of 0.038.
	Currently set based on the tube diameter.
	Equal to k*(ys + us) where ys = yield strength and us = ultimate strength. For SS316, approx equal 0.7*ultimate.
	Multiplier for for flow stress - standard deviation of 0.038.
	Currently set based on the tube diameter.
	Fraction of the percentage change in canister temperature that corresponds to change in gas temperature. Example: if value is 0.5 and the canister temperature doubles, then the gas temperature increases by 50%. Value of 0.5 is conservative.
	Equal to k*(ys + us) where ys = yield strength and us = ultimate strength. For SS316, approx equal 0.7*ultimate.
Creep rupture - Fast Heatup 0.5 inch.xls	0.5 inches is the minimum thickness.
	Uncertainty distribution derived from review of transportation cask SARs.
	This value comes from the separate canister heatup analysis. Value shown is typical of the long duration intense fires for which failure could occur.
	Fraction of the percentage change in canister temperature that corresponds to change in gas temperature. Example: if value is 0.5 and the canister temperature doubles, then the gas temperature increases by 50%. Value of 0.5 is conservative. for bare canister case; 1.0 is conservative for canister inside WP or cask.
	Pressure increases as canister temperature increases. Temperature of gas estimated based on separate heat transfer analyses.
	Multiplier for for flow stress - standard deviation of 0.038.
	Currently set based on the tube diameter.
	Equal to k*(ys + us) where ys = yield strength and us = ultimate strength. For SS316, approx equal 0.7*ultimate.
	Multiplier for for flow stress - standard deviation of 0.038.
	Currently set based on the tube diameter.
	Fraction of the percentage change in canister temperature that corresponds to change in gas temperature. Example: if value is 0.5 and the canister temperature doubles, then the gas temperature increases by 50%. Value of 0.5 is conservative.
	Equal to k*(ys + us) where ys = yield strength and us = ultimate strength. For SS316, approx equal 0.7*ultimate.

Table 1. Comments Identified within Excel files in Attachment H to PCSA Analyses (Continued)

Filename	Comment
Creep rupture - Fast Heatup 1 inch.xls	0.5 inches is the minimum thickness.
	Uncertainty distribution derived from review of transportation cask SARs..
	This value comes from the separate canister heatup analysis. Value shown is typical of the long duration intense fires for which failure could occur.
	Fraction of the percentage change in canister temperature that corresponds to change in gas temperature. Example: if value is 0.5 and the canister temperature doubles, then the gas temperature increases by 50%. Value of 0.5 is conservative. for bare canister case; 1.0 is conservative for canister inside WP or cask.
	Pressure increases as canister temperature increases. Temperature of gas estimated based on separate heat transfer analyses.
	Multiplier for for flow stress - standard deviation of 0.038.
	Currently set based on the tube diameter.
	Equal to k*(ys + us) where ys = yield strength and us = ultimate strength. For SS316, approx equal 0.7*ultimate.
	Multiplier for for flow stress - standard deviation of 0.038.
	Currently set based on the tube diameter.
	Fraction of the percentage change in canister temperature that corresponds to change in gas temperature. Example: if value is 0.5 and the canister temperature doubles, then the gas temperature increases by 50%. Value of 0.5 is conservative.
	Equal to k*(ys + us) where ys = yield strength and us = ultimate strength. For SS316, approx equal 0.7*ultimate.
YMP Fire Fragility - TAD in Cask with Fire HISTAR benchmark.xls	May change the parameters of this distribution based on Birk's review. [d]
	Use discrete distribution.
	=decay heat level adjusted to match the calculated initial heat loss from the TAD.
	This is the area of the container that receives heat from the fire and heats the munition. [f]
	This mass is the effective portion of the container heated by the fire. It controls the rate of temperature increase of the container. Fin effectiveness can be handled here.
	Represents the fraction of the "no-suppression case" heat input that reaches the munition. That is, a value less than 1.0 represents a reduction in the fire heating due to suppression. [f]
	This includes an effective convective coefficient = hconv*Fcfi*Fsup

Table 1. Comments Identified within Excel files in Attachment H to PCSA Analyses (Continued)

Filename	Comment
YMP Fire Fragility - TAD in WP - benchmark.xls	May change the parameters of this distribution based on Birk's review. [e]
	Use discrete distribution.
	=decay heat level adjusted to match the calculated initial heat loss from the TAD.
	This is the area of the container that receives heat from the fire and heats the munition.[f]
	This mass is the effective portion of the container heated by the fire. It controls the rate of temperature increase of the container. Fin effectiveness can be handled here.
	Represents the fraction of the "no-suppression case" heat input that reaches the munition. That is, a value less than 1.0 represents a reduction in the fire heating due to suppression. [f]
	This includes an effective convective coefficient = hconv*Fcfi*Fsup
YMP Fire Fragility - 0.5in TAD in Cask CB only.xls	May change the parameters of this distribution based on Birk's review. [e]
	Use discrete distribution.
	=decay heat level adjusted to match the calculated initial heat loss from the TAD.
	Neglect of top is conservative
	This is the area of the container that receives heat from the fire and heats the munition. [f]
	This mass is the effective portion of the container heated by the fire. It controls the rate of temperature increase of the container. Fin effectiveness can be handled here.
	Represents the fraction of the "no-suppression case" heat input that reaches the munition. That is, a value less than 1.0 represents a reduction in the fire heating due to suppression. [f]
	Must use this failure determination because the time-based failure condition doesn't work for canisters in casks, etc.
	This includes an effective convective coefficient = hconv*Fcfi*Fsup
YMP Fire Fragility - 0.5in TAD in Shielded Bell CB Only.xls	May change the parameters of this distribution based on Birk's review. [e]
	Use discrete distribution.
	=decay heat level adjusted to match the calculated initial heat loss from the TAD.
	Neglect of top is conservative
	This is the area of the container that receives heat from the fire and heats the munition. [f]

Table 1. Comments Identified within Excel files in Attachment H to PCSA Analyses (Continued)

Filename	Comment
YMP Fire Fragility - 0.5in TAD in Shielded Bell CB Only.xls (Continued)	This mass is the effective portion of the container heated by the fire. It controls the rate of temperature increase of the container. Fin effectiveness can be handled here.
	Represents the fraction of the "no-suppression case" heat input that reaches the munition. That is, a value less than 1.0 represents a reduction in the fire heating due to suppression. [f]
	Must use this failure determination because the time-based failure condition doesn't work for canisters in casks, etc.
	This includes an effective convective coefficient = hconv*Fcfi*Fsup
YMP Fire Fragility - 0.5in TAD in WP CB only.xls	May change the parameters of this distribution based on Birk's review. [e]
	Use discrete distribution.
	=decay heat level adjusted to match the calculated initial heat loss from the TAD.
	=decay heat level adjusted to match the calculated initial heat loss from the TAD.
	Neglect of top is conservative
	This is the area of the container that receives heat from the fire and heats the munition. [f]
	This mass is the effective portion of the container heated by the fire. It controls the rate of temperature increase of the container. Fin effectiveness can be handled here.
	Represents the fraction of the "no-suppression case" heat input that reaches the munition. That is, a value less than 1.0 represents a reduction in the fire heating due to suppression. [f]
	This doesn't work because the failure time would occur long after the fire ends.
	Must use this failure determination because the time-based failure condition doesn't work for canisters in casks, etc.
	This includes an effective convective coefficient = hconv*Fcfi*Fsup
YMP Fire Fragility - 0.5in TAD in Shielded Bell.xls	May change the parameters of this distribution based on Birk's review. [e]
	Use discrete distribution.
	=decay heat level adjusted to match the calculated initial heat loss from the TAD.
	Neglect of top is conservative
	This is the area of the container that receives heat from the fire and heats the munition. [f]

Table 1. Comments Identified within Excel files in Attachment H to PCSA Analyses (Continued)

Filename	Comment
YMP Fire Fragility - 0.5in TAD in Shielded Bell.xls (Continued)	This mass is the effective portion of the container heated by the fire. It controls the rate of temperature increase of the container. Fin effectiveness can be handled here.
	Represents the fraction of the "no-suppression case" heat input that reaches the munition. That is, a value less than 1.0 represents a reduction in the fire heating due to suppression. [f]
	Must use this failure determination because the time-based failure condition doesn't work for canisters in casks, etc.
	This includes an effective convective coefficient = hconv*Fcfi*Fsup
YMP Fire Fragility -1in TAD in WP CB only.xls	May change the parameters of this distribution based on Birk's review. [e]
	Use discrete distribution.
	=decay heat level adjusted to match the calculated initial heat loss from the TAD.
	=decay heat level adjusted to match the calculated initial heat loss from the TAD.
	Neglect of top is conservative
	This is the area of the container that receives heat from the fire and heats the munition. [f]
	This mass is the effective portion of the container heated by the fire. It controls the rate of temperature increase of the container. Fin effectiveness can be handled here.
	Represents the fraction of the "no-suppression case" heat input that reaches the munition. That is, a value less than 1.0 represents a reduction in the fire heating due to suppression. [f]
	This doesn't work because the failure time would occur long after the fire ends.
	Must use this failure determination because the time-based failure condition doesn't work for canisters in casks, etc.
	This includes an effective convective coefficient = hconv*Fcfi*Fsup
YMP Fire Fragility - 1in TAD in Cask CB only.xls	May change the parameters of this distribution based on Birk's review. [e]
	Use discrete distribution.
	=decay heat level adjusted to match the calculated initial heat loss from the TAD.
	Neglect of top is conservative

Table 1. Comments Identified within Excel files in Attachment H to PCSA Analyses (Continued)

Filename	Comment
YMP Fire Fragility - 1in TAD in Cask CB only.xls (Continued)	This is the area of the container that receives heat from the fire and heats the munition. [f]
	This mass is the effective portion of the container heated by the fire. It controls the rate of temperature increase of the container. Fin effectiveness can be handled here.
	Represents the fraction of the "no-suppression case" heat input that reaches the munition. That is, a value less than 1.0 represents a reduction in the fire heating due to suppression. [f]
	Must use this failure determination because the time-based failure condition doesn't work for canisters in casks, etc.
	This includes an effective convective coefficient = hconv*Fcfi*Fsup
YMP Fire Fragility - 1in TAD in Shielded Bell CB Only.xls	May change the parameters of this distribution based on Birk's review. [e]
	Use discrete distribution.
	=decay heat level adjusted to match the calculated initial heat loss from the TAD.
	Neglect of top is conservative
	This is the area of the container that receives heat from the fire and heats the munition. [f]
	This mass is the effective portion of the container heated by the fire. It controls the rate of temperature increase of the container. Fin effectiveness can be handled here.
	Represents the fraction of the "no-suppression case" heat input that reaches the munition. That is, a value less than 1.0 represents a reduction in the fire heating due to suppression. [f]
	Must use this failure determination because the time-based failure condition doesn't work for canisters in casks, etc.
	This includes an effective convective coefficient = hconv*Fcfi*Fsup
YMP Fire Fragility - 1in TAD in Shielded Bell.xls	May change the parameters of this distribution based on Birk's review. [e]
	Use discrete distribution.
	=decay heat level adjusted to match the calculated initial heat loss from the TAD.
	Neglect of top is conservative
	This is the area of the container that receives heat from the fire and heats the munition. [f]

Table 1. Comments Identified within Excel files in Attachment H to PCSA Analyses (Continued)

Filename	Comment
YMP Fire Fragility - 1in TAD in Shielded Bell.xls (Continued)	This mass is the effective portion of the container heated by the fire. It controls the rate of temperature increase of the container. Fin effectiveness can be handled here.
	Represents the fraction of the "no-suppression case" heat input that reaches the munition. That is, a value less than 1.0 represents a reduction in the fire heating due to suppression. [f]
	Must use this failure determination because the time-based failure condition doesn't work for canisters in casks, etc.
	This includes an effective convective coefficient = hconv*Fcfi*Fsup

NOTE: a. Includes: BSC 2008a, BSC 2008b, BSC 2008c, BSC 2008d, BSC 2008e, and BSC 2008f.

b. For the CRCF, the drawing was obtained prior to completion of the analysis, and the analysis was confirmed to be consistent with it. The current drawing was cited in CRCF analysis (i.e., BSC 2008a, Section 2, reference 2.2.32). This note in the WHF analysis (BSC 2008f) is not applicable, as it is an artifact from the use of the source spreadsheet from the CRCF.

c. Documentation provided as indicated in Table 6.3-10 of the analysis, under basic event, UCSNF_RC.

d. Reference was obtained and cited in text (see BSC 2007).

e. Superfluous comment on spreadsheet; an artifact from a previous use of the source spreadsheet.

f. The term, "munition", is an artifact from a previous use of the source spreadsheet and is used in the current context to represent the waste form in the analysis; it does not indicate that there is any form of ammunition present on the site.

AO = aging overpack; CRCF = Canister Receipt and Closure Facility; CTM = canister transfer machine; G.A. = general arrangement plan; HI-STAR = Holtec's HI-STAR spent fuel storage cask system; MVF = initials of PCSA manager; PCSA = Preclosure Safety Analysis; PEFA = passive equipment failure analysis; Phouc Le = PCSA analyst; RRU = unfiltered radionuclide release, not important to criticality; TAD = transportation, aging, and disposal; TEV = transport and emplacement vehicle; TT = truck trailer; UCSNF = uncanistered commercial spent nuclear fuel; WP = waste package.

Table 2. List of Remnant/Temporary Files in Attachment H to PCSA Analyses Not Applicable to the PCSA Results of Record

Source Document	Directory	Filename(s)	Size
Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis (BSC 2008a, Attachment H)	\CRCF Event Trees 2008-02-27 Locked	^TABLE.RTF	3,273 KB
		~$andard.rtf	1 KB
		~RULES.BAK	1 KB
		dummy	1 KB
		DUMMY.ETG	1 KB
		DUMMY.ETJ	1 KB
Intra-Site Operations and BOP Reliability and Event Sequence Categorization Analysis (BSC 2008b) Attachment H)	\IntraSite ETs Feb2008	~TMP.EMF	15 KB
		intrasite Oct 07.sra	0 KB
	\IntraSite FTs Feb2008	~tmp.emf	32 KB
		intrasite Oct 07.sra	0 KB
Initial Handling Facility Reliability and Event Sequence Categorization Analysis (BSC 2008c, Attachment H)	\IHF Project Files 02-27-2008 with end state uncertainty\IHF Project Files 02-27-2008	^TABLE.RTF	44 KB
		~freqfil.0FG	1 KB
		~RULES.BAK	1 KB
		~tmp.emf	20 KB
		IHF FOR LA.SRA	0 KB
		Copy of ESD-01 HLW.TXT	18 KB
		dummy	1 KB
		DUMMY.DLS	1 KB
		DUMMY.ETG	1 KB
		DUMMY.ETJ	1 KB
	\IHF Project Files 02-27-2008 with end state uncertainty \IHF Project Files 02-27-2008\RULES	~tmplk.tmp	1 KB

Table 2. List of Remnant/Temporary Files in Attachment H to PCSA Analyses Not Applicable to the PCSA Results of Record (Continued)

Source Document	Directory	Filename(s)	Size
Receipt Facility Reliability and Event Sequence Categorization Analysis (BSC 2008d Attachment H)	\RF\RF 14	~200-CTT-COLLIDE.dls	2 KB
		~200-DPC-TC-IMPACT.dls	3 KB
		~200-ST-COLLISION2.dls	3 KB
		~200-TAD-CRANE-DROP.dls	2 KB
		~200-TAD-TC-IMPACT.dls	3 KB
		~CTM-SB-2.dls	5 KB
		~CTM-SB-4.dls	3 KB
		~CTM-SB-6.dls	5 KB
		~CTM-SB-7.dls	5 KB
		~CTM-SPURIOUS-MOVEMENT.dls	5 KB
		~EP-RF-2A.dls	4 KB
		~ESD12-BOLT-FIRE-CSK-DSL.dls	1 KB
		~ESD12-LARGE-FIRE.dls	1 KB
		~ESD12-LOAD-FIRE-CSK-DSL.dls	1 KB
		~ESD12-PREP-FIRE-CAN.dls	1 KB
		~ESD12-PREP-FIRE-CSK-DSL.dls	1 KB
		~ESD12-PREP-FIRE-CSK.dls	1 KB
		~ESD12-UNLD-FIRE-CAN.dls	1 KB
		~ESD12-XFER-FIRE-CSK.dls	1 KB
		~GATE-37-1.dls	4 KB

Table 2. List of Remnant/Temporary Files in Attachment H to PCSA Analyses Not Applicable to the PCSA Results of Record (Continued)

Source Document	Directory	Filename(s)	Size
Receipt Facility Reliability and Event Sequence Categorization Analysis BSC 2008d, Attachment H) (Continued)	\RF\RF 14	~RULES.BAK	6 KB
		~tmp.emf	20 KB
		dummy	1 KB
		Copy of EP-ITS-DG-B.DLS	5 KB
		Copy of EP-RF-2A.DLS	4 KB
		Copy of EP-RF-52A.DLS	4 KB
		Copy of EP-RF-A5.DLS	10 KB
		Copy of EP-RF-B5.DLS	10 KB
	\RF\Final RF ITS AC	^TABLE.RTF	1,523 KB
		~RULES.BAK	2 KB
		~tmp.emf	42 KB
		WHF---VOL-II-DRAFT-FT.RTF	4,645 KB
		dummy	1 KB
Subsurface Operations Reliability and Event Sequence Categorization Analysis (BSC 2008e, Attachment H)	\Subsurface final 2008-03-05	^TABLE.RTF	3,273 KB
		~$andard.rtf	1 KB
		~RULES.BAK	1 KB
		FaultTreesCRCF.sra	0 KB
		dummy	1 KB
		DUMMY.ETG	1 KB
		DUMMY.ETJ	1 KB
		wmf test.wmf	162 KB

Table 2. List of Remnant/Temporary Files in Attachment H to PCSA Analyses Not Applicable to the PCSA Results of Record (Continued)

Source Document	Directory	Filename(s)	Size
Wet Handling Facility Reliability and Event Sequence Categorization Analysis (BSC 2008f, Attachment H)	\Final WHF ITS AC	^TABLE.RTF	1,523 KB
		~RULES.BAK	2 KB
		~tmp.emf	51 KB
		WHF - Vol II DRAFT.sra	0 KB
		WHF---VOL-II-DRAFT-FT.RTF	4,645 KB
		dummy	1 KB
	\Loss of Delta Pressure in WHF - 24HR VERSION	~HVAC2-IN-CRCF-FAILS.dls	5 KB
		~HVAC-TRAIN-A-FAILS.dls	11 KB
		~HVAC-TRAIN-B-FAILS.dls	11 KB
		~tmp.emf	38 KB
		WHF-HVAC-COOLING.SRA	0 KB
		Copy of EP-ITS-DG-A-1.DLS	4 KB
	\WHF - Vol II FINAL with uncertainties\WHF - Vol II FINAL	Alphabetical list of temporary files (331 files): ~050-1-SPMTT-COLLISION.dls --to-- ~TRAN-2-1.dls	Various Sizes
		WHF - Vol II DRAFT.sra	0 KB